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CHEMICAL AND OTHER MANUFACTURING POSSIBILITIES FOR THE CENTRAL SAVANNAH RIVER AREA

Prepared for

Central Savannah River Area
Planning and Development Commission

by

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Foreword

This is the first of a series of technical reports in process to be completed as part of contract research being carried out for the Central Savannah River Area Planning and Development Commission. On the basis of this analysis, a special study will be made in depth of the potentials for attracting a synthetic fiber plant to the area.

Reports in process include an analysis of selected industrial sites in the 13-county area under study, audits of economic resources of 12 of the 13 counties, and an evaluation of the existing labor market conditions throughout the area.

Inquiries regarding any of the work in process as part of the first year's research will be welcomed.

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Summary

The factors which have been responsible for the development of the chemical complex in Augusta are of greater significance to the future industrial growth of the Central Savannah River Area than is the existence of the complex itself. Principal among these factors is the CSRA's central location in the southeastern market.

Raw material attractions in the CSRA include the presence of a few natural resources -- wood, clay, and sand -- and the availability of natural gas at prices which are sufficiently low to make the manufacture of methane-based products feasible. Other attractions are the area's access to the navigable Savannah River, abundant surface and ground water supplies, the CSRA's active interest in new industry, and a good labor supply with a growing vocational-technical training program.

Based on a consideration of these manufacturing attractions, 11 chemical and chemical-related products and product groups have been identified as manufacturing possibilities for the CSRA. Preliminary investigations of these possibilities indicate that they may be classified by degree of potentiality into the following groups:

Best prospect:

Synthetic fibers

Good prospects:

Fatty acids and glycerine
Methanol, formaldehyde, and methylamines
Pesticides
Phenol

Uncertain prospects:

Acetylene and acetylene chemicals
Acrylonitrile
Methylene dichloride and perchloroethylene

Limited or long-range prospects:

Carboxymethyl cellulose
Salt cake and hydrochloric acid
Sodium chlorate

Manufacturing opportunities in the CSRA include several which are not directly related to the chemical field. Although the degree of potentiality of each cannot be determined from preliminary investigations, the following appear to be especially suited to the area:

1. Expansion of the pulp and paper industry, especially in the fields of newsprint and foodboard.
2. Manufacture of printed cartons for the southeastern and perhaps national market.
3. Manufacture of non-combustible wood fiber board from long-strand wood fibers and sodium silicate.
4. Manufacture of consumer products such as paint, detergents, and beer.
5. Development of a fabricated metal products industry and subsequent manufacture of specialty metal chemicals.
6. Attraction of ceramics and glass manufacturers (particularly flat glass, table glassware, and scientific glass) to utilize the area's abundant clay and sand resources.

INTRODUCTION

The original purpose of this study was to investigate possibilities of developing satellite industries based upon Augusta's existing chemical complex. The possibilities were to fall into two groups -- those satellite industries which would supply raw materials to the existing complex, and those which would manufacture or process products from the raw materials presently produced by the complex.

As the study developed, it became evident that the results would be more meaningful if the scope of the investigation were broadened somewhat. This was done in two ways. First, a considerable number of industries which can not be called satellite in the strictest meaning of the term were examined as possible prospects. Those which appeared to be good prospects are described in the body of this report. Generally, the reason for examining any non-satellite prospect was that the product involved was known to have a large market in the Southeast.

Second, the study was not limited to a strict definition of the chemical industry. The raw material needs of the Southeast's textile and pulp and paper industries were examined in some detail, and the needs of Augusta's ceramics industry were considered. The prospects for manufacturing a broad range of non-chemical products were also examined, although in less detail than the more promising chemical industry prospects. These non-chemical products which appear to be suited to the area are briefly mentioned in the section entitled "Other Products."

The major advantage of the more broadly defined study is its applicability to the entire Central Savannah River Area (CSRA). Since any strictly satellite chemical industry would locate as close as practicable to its raw material suppliers or to the customers for its product, the original study would have been restricted by definition to manufacturing possibilities suited only to Augusta and the immediate vicinity. On the other hand, prospects pointed up as a result of the broader definition of this study may logically select sites at other locations in the CSRA. It should be recognized, however, that competition for prospects which are not directly tied to Augusta's chemical complex is much more intense, since these firms may more readily choose sites in many other parts of the southeastern market.

MANUFACTURING ATTRACTIONS IN THE CSRA

Augusta's Chemical Complex

Although a chemical complex has developed rapidly in recent years in Augusta, it is still not of sufficient size and diversity to be a major factor in attracting satellite firms to provide raw materials for existing operations or to manufacture products from the raw materials which are presently produced in the area.

The Procter & Gamble Manufacturing Company, Inc., is the only large industrial consumer in the Augusta chemical complex whose raw material needs might affect the location of a supplier. Of its large volume purchases which could be produced at Augusta, only two are not already supplied by local manufacturing plants. These are carboxymethyl cellulose and printed cartons.

The plant of E. I. du Pont de Nemours & Company produces sodium silicate solutions and glasses, and supplies raw materials to Procter & Gamble. Its products are used by many industries and could play a role in attracting some additional industry to the area.

Monsanto Chemical Company produces sodium tripolyphosphate and fertilizer-grade phosphoric acid. Sodium tripolyphosphate and other sodium phosphates which Monsanto is likely to produce are used in the food, paint, paper, pesticide, and clay industries, in specialty textile and metal chemicals, and in water softening. These are not, however, important enough raw materials in any industry to affect plant location. Of course, any user like Procter & Gamble which buys directly from a manufacturer will benefit from buying locally.

The Columbia Nitrogen Corporation plant, presently under construction, will produce ammonia and nitric acid initially and is likely to produce urea at a later date. In chemical grades these products have broad applications, some of which are noted in this report. Their availability can be a factor in locating plants for the manufacture of certain products, such as plastics and synthetic fibers.

Chlorine and caustic soda are not now produced at Augusta, but they likely will be in the near future. This study assumes that they are part of the existing complex. Both products are important enough as raw materials to affect plant locations. Chlorine is an especially versatile chemical and

usually represents a large part of the weight of products made with it. Consequently, it is frequently worthwhile to bring other raw materials to a source of chlorine for conversion to the final product.

The Augusta Chemical Company, a pioneer in Augusta's chemical complex, produces dyestuffs and organic chemicals. Its purchases and products will not affect the location of a satellite industry, but its presence could bring Augusta to the attention of other specialty chemical manufacturers.

American Cryogenics, Inc., engineers and operates plants to produce industrial gases. Its Marks Oxygen Company plant in Augusta does not have the capacity to produce chemical raw material gases in volume, but the company's interest in Augusta would make it a likely candidate for the construction of a large tonnage plant at the site of a company with large volume requirements which might come to Augusta.

Other companies considered by this study as part of the Augusta chemical complex are Continental Can Company, Inc. (pulp and paper), Southern Glassine Company (glassine paper), and The Babcock & Wilcox Company (refractory materials).

Other Manufacturing Attractions

Except for the pulp and paper and ceramics industries, raw materials have not played a large part in attracting industry to the Central Savannah River Area. This holds true generally throughout the Southeast. Instead, the area is bustling with the activity of chemical processors who intend to serve the regional market more effectively. Some, like Procter & Gamble, want to save on distribution costs to growing consumer markets. Others want to supply the Southeast's traditional industrial markets -- the pulp and paper and textile industries -- and agriculture. Columbia Nitrogen, which will produce fertilizer materials, is an example.

The CSRA's major attraction for the chemical industry is its central location in the southeastern market. To manufacturers of selected chemical products it offers savings in transportation costs to the regional market which more than compensate for the added cost of shipping in those raw materials which are not produced locally.

Among the area's few naturally occurring raw materials are wood, clay, and sand. Continental Can is the only company drawing from the area's extensive wood supply. Babcock & Wilcox and Merry Brothers Brick Company use large quantities of clay. The area's sand deposits, some of which appear to be suitable for glass manufacture, are not presently used to anywhere near the extent justified by the quantity available.

Natural gas prices in the CSRA are another attraction. Firm gas can be purchased for 40¢ per 1,000 standard cubic feet (SCF), and interruptible rates run less than 28¢ per 1,000 SCF. Similar rates apply in much of Georgia and Alabama. While rates are lower in Mississippi, Louisiana, and Texas, they are higher in South Carolina and other more northern states along the pipe lines. Augusta is the farthest point from the wellheads which has reasonable gas rates.

The navigable Savannah River makes Augusta the most inland port in the Southeast with immediate access to the East Coast section of the Intracoastal Waterway. Manufacturers can barge in materials from most ports on the East Coast and convert them to products with large markets in the Southeast. This fact should make the CSRA an especially attractive location for the manufacture of synthetic fibers.

Both surface and ground water supplies are available in some parts of the CSRA. The Savannah River discharges about 10,000 cubic feet per second at Augusta, with extremes of 5,000 and 30,000 cubic feet per second. Flow (and consequently, temperature) is regulated by power operations and reservoirs located above the area. Ground water supplies are especially attractive in the area south of the fall line -- Burke, Emanuel, Jefferson, Jenkins, and Screven counties. Yields from existing wells range from 50 to 1,200 gallons per minute; water is generally soft with temperatures about 65^{o} F. No great demands have been made on the confined ground water, so no one has seriously investigated the adequacy of the supply.

The CSRA's active interest in new industry is a definite asset. Experience has shown that when a company is considering several communities for a new plant site, the community which is most effective in providing the prospective manufacturer with the information he needs has the advantage. Follow-up interest in new members of the industrial community is also essential. The

new chemical companies which have come to the CSRA have frequently commented on their pleasant receptions.

The area's labor supply is a further attraction. While newer plants may require less labor, it must be of a higher quality, according to one chemical company manager; he was impressed with what he found in the CSRA. Non-chemical manufacturers should find the quality of the area's labor supply even more attractive, although some manufacturers may be discouraged by the fact that the area's labor must be classified as "trainable" rather than "skilled." However, the growing vocational-technical training program in the area should contribute to the resolution of this problem.

MANUFACTURING POSSIBILITIES FOR THE CSRA

Based on a consideration of the manufacturing attractions in the area, 11 chemical and chemical-related products and product groups have been identified as manufacturing possibilities in the Central Savannah River Area. In addition, several non-chemical products are mentioned as possible manufacturing opportunities because of their relation to one or more of the area's attractions.

Most of the products discussed or mentioned in this section would be shipped to the southeastern market. Some could be shipped to the national market. Manufacturing locations for only two -- carboxymethyl cellulose and printed cartons -- might be affected by markets within the CSRA.

Locally produced chemicals used in the products discussed include ammonia, caustic soda, chlorine, and sodium silicate. Locally occurring natural resources used include clay, sand, and wood.

Raw materials used which are available within the Southeast include sulfuric acid, hydrochloric acid, cellulose, and animal and vegetable fats and oils. Sulfuric acid is relatively cheap at Augusta because of the Tennessee Corporation's plant at Copperhill, Tennessee. Low-cost hydrochloric acid is a by-product of Hercules Powder Company's insecticide operation at Brunswick.

One of the principal raw materials for many of the product possibilities is natural gas. Although natural gas is not produced locally, it is available in abundant quantities and at a reasonable price. Figure 1 shows some of the chemicals which are being made or can be made from natural gas.

Raw materials which must be imported into the area from outside the Southeast include methanol, benzene, propylene, and other organics and salt.

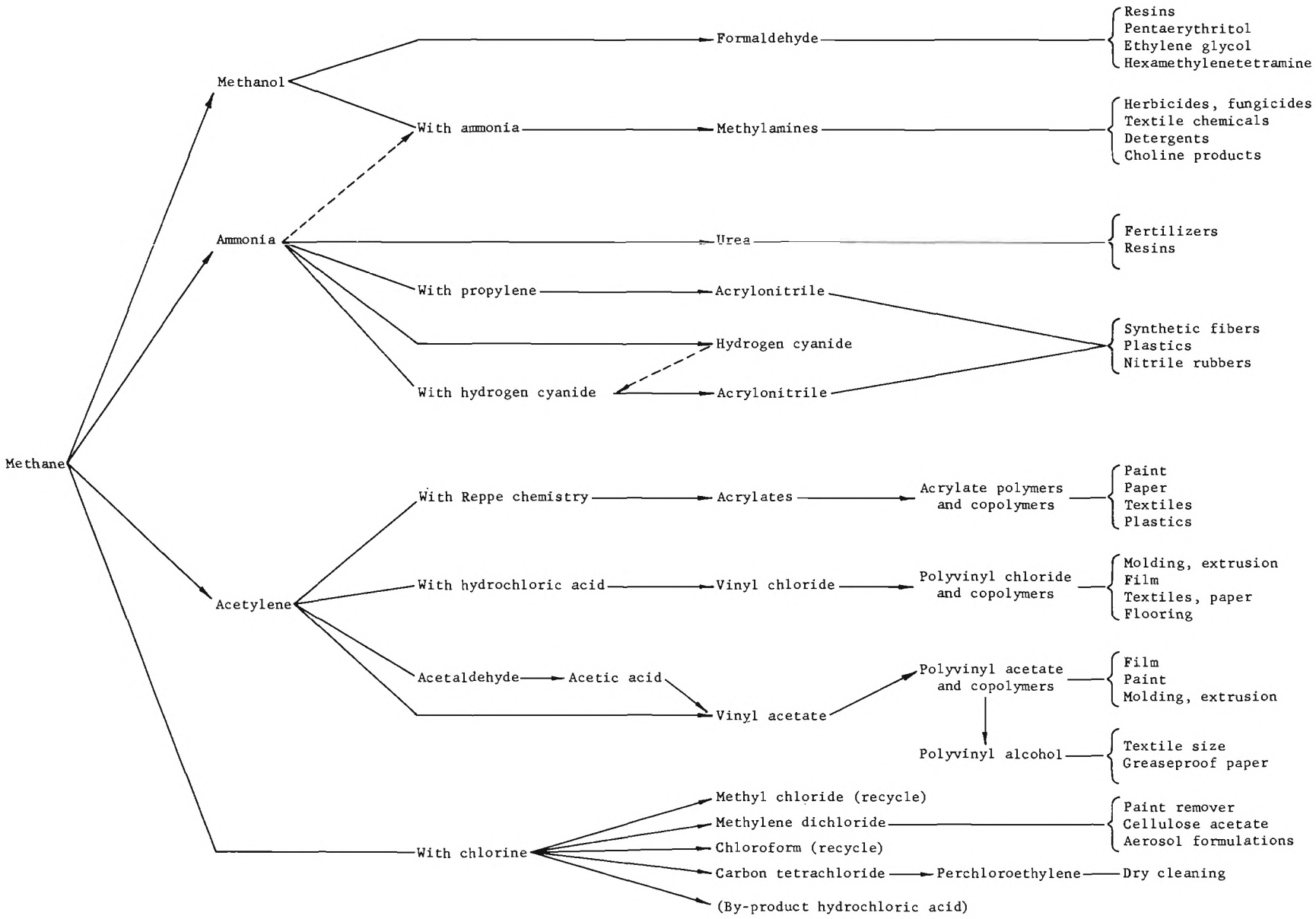
In no case has either the market for a product or the process for producing it been investigated in sufficient depth to recommend a plant location. In every case, however, the product and process appear to have some potential for the area.

Synthetic Fibers

The Southeast is the most likely place for continued growth of the synthetic fibers industry. The best plant sites are those on navigable water.

Figure 1

SOME NATURAL GAS PRODUCTS AND THEIR USES



Whether or not the plant intends to ship in raw materials by water, the existence of this possibility is helpful in securing the lowest possible freight rates.

The CSRA can offer synthetic fiber manufacturers a navigable waterway, proximity to major textile markets in the Piedmont region, and an excellent ground water supply in the Coastal Plain counties. These advantages make the area one of the most desirable locations in the Southeast.

Volume fibers which appear to have good growth potential include polyester, acrylic, and nylon fibers. Each is presently produced in the Southeast, and each could be produced at Augusta.

Another section of this report points up the possibility of producing acrylonitrile at Augusta. The attraction of acrylic fiber manufacturers to the CSRA is not dependent upon a local source of acrylonitrile. On the other hand, the presence of an acrylic fiber manufacturer would make the area more attractive for the manufacture of acrylonitrile.

Nylon manufacturers could either buy or manufacture their intermediate raw materials. A new plant could barge in caprolactam from Virginia. If immediate or eventual production of intermediates were preferred, ammonia -- one of the essential raw materials -- could be procured locally, and the other starting materials could be brought in from East Coast or Gulf Coast sources.

Some major manufacturers of synthetic fibers are listed below.

Allied Chemical Corporation
American Cyanamid Company
American Enka Corporation
Chemstrand Corporation
E. I. du Pont de Nemours & Company
Fiber Industries, Inc.
(Imperial Chemical Industries, Ltd., and Celanese Corporation of America)
Tennessee Eastman Company

Fatty Acids and Glycerine

Animal and vegetable fats and oils may be hydrolyzed to yield fatty acids and glycerine. Fatty acids find a large southeastern market in the textile chemical industry which converts them to esters, nitriles, amides, amines, and sulfonates. They are also used in the manufacture of soap, lubricants, and

edible products. Glycerine is used in the processing of alkyd resins and ester gums, cellophane, explosives, tobacco, and glassine papers.

Until recently, the nearest sources of fatty acids were in Memphis and Philadelphia. Tall oil fatty acids have been produced in Georgia for several years, but they are not believed to have the same applications. In 1962, Chemol, Inc., began production of fatty acid esters and hydrogenated oils and fats at Greensboro, N. C.

The manufacture of fatty acids and glycerine at Augusta is primarily dependent on raw material availability. Meat-packing and rendering plants, major sources of tallow and greases, are widely scattered over the Southeast, with a slight concentration in Atlanta. The area's vegetable oil industry should have large quantities of foots available. Apparently the area has a large supply of some grades of raw materials, since a shipment was recently exported through the port of Savannah.

Some manufacturers of fatty acids and glycerine are listed below.

Archer-Daniels-Midland Company
Armour Industrial Chemical Company
Arnold, Hoffman & Company, Inc.
Atlas Powder Company
Darling and Company
Distillation Products Industries
Emery Industries, Inc.
General Mills
Mallinckrodt Chemical Works
Swift & Company
Wallace and Tiernan, Inc.
Wilson & Company

Methanol, Formaldehyde, and Methylamines

Methanol is used in the manufacture of formaldehyde, methylamines, and other chemicals. It is a solvent as well. It has a large market in the Southeast, but the area's only manufacturer of synthetic methanol is located at Pensacola, Florida. Minor amounts come from wood distillation. Methanol can be made at Augusta from natural gas. (See Figure 1.) It can also be brought in by barge if a manufacturer of formaldehyde or methylamines does not wish to make methanol.

The chief outlet for methanol is in the manufacture of formaldehyde. Formaldehyde is used for manufacturing resins (phenol-, urea-, and melamine-formaldehyde resins), pentaerythritol (for resins, plastics, and drying oils),

ethylene glycol (for anti-freeze, cellophane, dynamite, and terephthalate resins), and hexamethylenetetramines (for plastics, resins, and medicinals). Formaldehyde is made in Alabama and North Carolina, but there are several companies which could strengthen their position in the southeastern market by building formaldehyde facilities at Augusta.

Methanol can also be used to manufacture methylamines. The process requires ammonia, which is available in Augusta. Methylamines are used in the manufacture of herbicides and fungicides, textile chemicals, rubber accelerators, detergents, and choline products. The nearest sources of supply are Kingsport, Tennessee, and Pensacola, Florida.

Some manufacturers of methanol, formaldehyde, and methylamines are listed below.

Methanol

Allied Chemical Corporation
Amoco Chemicals Corporation
Borden Chemical Company
Celanese Corporation of America
Commercial Solvents Corporation
E. I. du Pont de Nemours & Company
Escambia Chemical Corporation
Hercules Powder Company
Heyden Newport Chemical Corporation
Monochem, Inc.
Olin Mathieson Chemical Corporation
Rohm & Haas Company
Spencer Chemical Company
Tenneco Company
Union Carbide Chemicals Company
Warren Petroleum Corporation

Formaldehyde

Allied Chemical Corporation
Borden Chemical Company
Celanese Corporation of America
Commercial Solvents Corporation
E. I. du Pont de Nemours & Company
Hercules Powder Company
Heyden Newport Chemical Corporation
Hooker Chemical Corporation
Kay-Fries Chemicals, Inc.
Merck & Company, Inc.
Monsanto Chemical Company
Olin Mathieson Chemical Corporation
Reichhold Chemicals, Inc.
Rohm & Haas Company
Spencer Chemical Company

Formaldehyde (continued)

Trojan Powder Company
Union Carbide Chemicals Company
Warren Petroleum Corporation

Methylamines

Commercial Solvents Corporation
E. I. du Pont de Nemours & Company
Escambia Chemical Corporation
Monsanto Chemical Company
Pennsalt Chemicals Corporation
Rohm & Haas Company
Tennessee Eastman Company
Union Carbide Chemicals Company

Pesticides

Pesticide manufacture is not one of the glamorous segments of the chemical industry, but it is enjoying rapid growth. The Southeast consumes far more pesticides than it produces, and there are both service and transportation advantages to producing in the market area. Because of the importance of export markets, easy access to an uncongested deepwater port is advantageous.

Pesticides include insecticides, fungicides, herbicides, and the less important specialties, nematocides and rodenticides. Insecticides are the most important pesticide, accounting for nearly half the market. Fungicides and herbicides have about a quarter of the market each.

Insecticide manufacturers have witnessed slackening growth of their markets. Competitive activity has led to lower prices and less chance of an important sales advantage through the introduction of new products. Of the nearly 100 commercial chemical compounds used as insecticides, DDT is produced in by far the greatest volume. While domestic consumption of DDT has not grown appreciably since 1955, exports have climbed steadily to the point where they now exceed domestic consumption.

Manufacturers are now operating at close to total capacity, so additional facilities may be built. But both domestic and export markets face limiting pressures. The domestic market may be affected by stricter Federal controls on pesticides. The export market is largely dependent on malaria eradication programs which are likely to dwindle in magnitude. Moreover, expanding foreign plants are likely to compete more aggressively in world trade, thereby restraining U. S. exports.

DDT is made from chloral, monochlorobenzene, and sulfuric acid. Chloral and monochlorobenzene are easily available from eastern sources in car lots at reasonable prices, so a small DDT manufacturer need not produce these materials. Competitive manufacture of these intermediates would require large-scale operation and successful recovery and sale of by-products. Sulfuric acid, representing about 60% (by weight) of the raw material input for DDT, is available in Augusta at low prices.

Fungicide markets are growing at about 5% per year, only slightly faster than insecticide markets. None of the nearly 100 commercial chemical compounds used as fungicides have obvious potential for the CSRA.

Herbicides are showing the greatest growth of all the pesticides. Sales in 1962 were more than three times as great as sales in 1956. Where herbicides were once used to improve crop yields, they are now also used to decrease crop production costs by eliminating farm labor.

Present volume leader among herbicides is 2,4-D. Exports of this chemical have climbed steeply in recent years. Raw material requirements for 2,4-D are, by weight, two parts dichlorophenol, hydrochloric acid, and caustic soda (50%), and one part monochloroacetic acid. Both chlorinated organics can be brought in from eastern sources. Caustic soda is available locally, and inexpensive hydrochloric acid can be brought in from Brunswick.

It appears that dichlorophenol must be purchased at below market price, if 2,4-D is to be produced at competitive prices. This means either that 2,4-D must be made by companies which manufacture dichlorophenol elsewhere, such as Diamond Alkali Company and Monsanto Chemical Company, or that both 2,4-D and dichlorophenol must be made at Augusta by the same company.

Pesticide manufacture involves two kinds of processes -- the production of basic toxicants, such as DDT and 2,4-D, and the production of branded formulations. A relatively small number of companies produce a few hundred basic toxicants, but more than 100 companies combine basic toxicants with carriers and extenders to produce about 10,000 branded formulations.

Major producers of basic toxicants, some of which also produce branded formulations for the consumer markets, are listed below.

Allied Chemical Corporation
American Chemical Paint Company
American Cyanamid Company

American Potash & Chemical Corporation
Baldwin-Montrose Chemical Company, Inc.
California Spray-Chemical Corporation
Chemagro Corporation
Chipman Chemical Company, Inc.
Diamond Alkali Company
Dow Chemical Company
E. I. du Pont de Nemours & Company
Food Machinery & Chemical Corporation
Frontier Chemical Company
Geigy Chemical Corporation
Hercules Powder Company
Monsanto Chemical Company
Olin Mathieson Chemical Corporation
Pennsalt Chemicals Corporation
Pittsburgh Plate Glass Company
Rohm & Haas Company
Shell Chemical Company
Stauffer Chemical Company
United States Rubber Company
Velsicol Chemical Corporation

The following are some of the major independent formulators of pesticide products:

American Agricultural Chemical Company
Chapman Chemical Company
Coahoma Chemical Company
Cotton States Chemical Company
Hayes-Sammons Chemical Company
Imperial Chemical Company
Miller Chemical & Fertilizer Corporation
Planters Chemical Company
Port Fertilizer Company
Riverside Chemical Company
Wilson & Toomer Fertilizer Company
Woodbury Chemical Company

Phenol

The Southeast uses phenolic resins primarily for the manufacture of paper, insulation, friction products, plywood, laminates, and foundry resins. Phenol is also used to manufacture alkyl phenols, 2,4-D (see preceding section on pesticides), and other chemicals. The only source of synthetic phenol in the South is Reichhold Chemicals, Inc., at Tuscaloosa, Alabama. Only very small amounts of natural phenol are derived from coke-oven operations and coal tar distillation.

Of the several competitive processes for manufacturing phenol, the sulfonation of benzene appears to be the most suitable for Augusta. Critical

requirements, all of which can be met at Augusta, are cheap sulfuric acid and caustic soda and a nearby outlet for by-product sodium sulfate and sulfite (i. e., paper mills). Benzene can be brought in by barge from East Coast sources, or by rail from Alabama or North Carolina.

Manufacturers of synthetic phenol are listed below.

Allied Chemical Corporation
California Chemical Company
Hercules Powder Company
Hooker Chemical Corporation
Monsanto Chemical Company
Reichhold Chemicals, Inc.
Union Carbide Chemicals Company

Acetylene and Acetylene Chemicals

Acetylene is an unusually versatile chemical building block. Figure 1 shows a few of the chemicals which can be made from acetylene -- those which appear to be the best prospects for the CSRA. Because it is difficult to ship acetylene, it would be necessary to bring in a complex of plants which would produce both acetylene and acetylene products.

By the way of modern processes for producing acetylene from methane, it may be possible to manufacture competitively priced acetylene products within the CSRA. The cost of producing hydrocarbon acetylene will actually be higher in the CSRA than along the Gulf Coast because of the higher cost for natural gas. It appears that the cost disadvantage would be less than 0.5 cent per pound if a partial oxidation process is used, however. This conclusion is tentative because acetylene technology is developing rapidly, and the relative economics of the many new processes is changing.

A complex using acetylene to produce acrylates, vinyl chloride, and vinyl acetate could probably compete with the bigger and lower cost operations on the Gulf Coast because of the savings in transporting acetylene derivatives to users in the Southeast. Freight savings could run as high as 1.3 cents per pound for products costing less than 10.0 cents per pound.

Total savings would be much higher than the 0.8 cent per pound differential between freight savings and increased acetylene cost because it takes less than one pound of acetylene to make one pound of final product. Other materials used in the manufacture of the final products, such as hydrochloric acid, oxygen,

water, carbon monoxide and alcohols, either are locally produced or can be made available in the area at competitive prices.

Some manufacturers of hydrocarbon acetylene, acrylates, vinyl chloride and vinyl acetate are listed below. None now operate commercial plants for these chemicals in the Southeast.

Acetylene

American Cyanamid Company
Diamond Alkali Company
Dow Chemical Company
E. I. du Pont de Nemours & Company
Monochem, Inc.
Monsanto Chemical Company
Phillips Petroleum Company
Rohm & Haas Company
Tenneco Company
Tennessee Eastman Company
Union Carbide Chemicals Company

Acrylates

B. F. Goodrich Chemical Company
Celanese Corporation of America
Dow Chemical Company
Rohm & Haas Company
Union Carbide Chemicals Company

Vinyl Chloride

Air Reduction Chemical & Carbide Company
Allied Chemical Corporation
B. F. Goodrich Chemical Company
Diamond Alkali Company
Dow Chemical Company
Ethyl Corporation
General Tire & Rubber Company
Goodyear Tire & Rubber Company
Monsanto Chemical Company
Sieberling Rubber Company
Union Carbide Chemicals Company
United States Rubber Company

Vinyl Acetate

Air Reduction Chemical & Carbide Company
Celanese Corporation of America
E. I. du Pont de Nemours & Company
Monsanto Chemical Company
National Starch & Chemical Corporation
Union Carbide Chemicals Company

Acrylonitrile

The market for acrylonitrile is tied primarily to the market for acrylic and acrylic-type synthetic fibers (Acrilan, Creslan, Dynel, Orlon, Verel, Zefran). These fibers appear to have a bright future in the textile field. Acrylonitrile is also used in the manufacture of plastics and nitrile rubbers.

While the area market for acrylonitrile is clearly large, the prospects for local production are clouded. Most acrylonitrile is produced from acetylene and hydrogen cyanide. Recently, this process has been hard pressed to compete with the newer, propylene-based methods. At least one company has discontinued production of acrylonitrile from acetylene in favor of new propylene-based facilities. (See Figure 1.)

Since the area market is large, a case can probably be made for bringing in propylene from the Gulf Coast. In addition to propylene the process requires ammonia, which is available in Augusta. However, it is possible that progress now being made in the technology of acetylene production from natural gas will make acetylene the preferable raw material at Augusta.

Some major manufacturers of acrylonitrile are listed below.

American Cyanamid Company
Borden Chemical Company
B. F. Goodrich Chemical Company
Monsanto Chemical Company
Union Carbide Chemicals Company

Methylene Dichloride and Perchloroethylene

The reaction between chlorine and methane in the presence of light or a catalyst yields four substitution products -- methyl chloride, methylene dichloride, chloroform, and carbon tetrachloride. If methylene dichloride and carbon tetrachloride are desired in the largest amounts, the less desired chloromethanes can be recycled to the chlorinator. Perchloroethylene can be formed by pyrolysis of carbon tetrachloride. (See Figure 1.)

Methylene dichloride is widely used in formulating paint and varnish removers and in the manufacture of photographic film. Nearest producers are in Kentucky and West Virginia. The other chloromethanes are less applicable to the southeastern market.

The Southeast comprises a large and rapidly growing market for perchloroethylene, the leading dry cleaning solvent. Because of the popularity of coin

operated dry-cleaning units, rising United States perchloroethylene demand is expected to out-strip present capacity. In spite of competition from imported material, new plants and capacity expansions will probably be built. The nearest source of supply to the Southeast is Kentucky.

Raw material costs of a producer of methylene dichloride and perchloroethylene in the Augusta area would be greater than those of a producer nearer the source of natural gas. Production costs would be greater than those of a producer near a market for all the products derived from chlorine and methane, since a local manufacturer would incur additional recycling costs in reducing the end products to those which could be sold in the southeastern market. Therefore, the feasibility of producing methylene dichloride and perchloroethylene locally depends upon whether or not these cost differentials could be overcome by the savings in transporting finished products to the southeastern market from Augusta.

Manufacturers of these two chemicals are listed below.

Methylene dichloride

Allied Chemical Corporation
Diamond Alkali Company
Dow Chemical Company
E. I. du Pont de Nemours & Company
Frontier Chemical Company
Stauffer Chemical Company

Perchloroethylene

Detrex Chemical Industries, Inc.
Diamond Alkali Company
Dow Chemical Company
E. I. du Pont de Nemours & Company
Frontier Chemical Company
Hooker Chemical Corporation
Kraft Chemical Company
Pittsburgh Plate Glass Company
Stauffer Chemical Company
Tect, Inc.

Carboxymethyl Cellulose

The principal use for carboxymethyl cellulose is in the manufacture of detergents. Smaller but more promising fields of use include laundry starch replacement, soil conditioners, textile size, paper coatings, latex paint stabilizer, and pharmaceuticals.

Carboxymethyl cellulose, in the form of its sodium salt, is made from cellulose, monochloroacetic acid, caustic soda, and water. Caustic soda and cellulose are the heaviest inputs. Caustic is available locally, and cellulose may be produced within the CSRA or brought in from Foley, Florida, or other points.

Augusta's greatest attraction for this product is its marketing position. This position is complicated by the fact that Procter & Gamble presently purchases carboxymethyl cellulose from a subsidiary, Buckeye Cellulose Corporation, at Memphis. It is further complicated by the fact that Buckeye owns the major cellulose source at Foley, Florida. Consequently, it would appear that Buckeye is the only logical prospective manufacturer of carboxymethyl cellulose at Augusta.

Manufacturers of carboxymethyl cellulose are listed below.

Buckeye Cellulose Corporation
E. I. du Pont de Nemours & Company
Hercules Powder Company
Wyandotte Chemicals Corporation

Salt Cake and Hydrochloric Acid

The kraft pulp industry, which is so highly concentrated in the Southeast, uses about three quarters of all the salt cake (sodium sulfate) produced in this country. Other uses include the manufacture of detergents, glass, textiles, and ceramics. Although most of the U. S. market is in the Southeast, only a few of the more than 50 plants producing salt cake are located in the area.

The few southeastern plants produce salt cake as a by-product of the manufacture of either rayon or phenol. The former source has never been fully exploited because of high recovery costs, and there is no reason to expect it to be expanded in the future. The latter source is likely to be expanded as is recommended elsewhere in this report (see Phenol section), but regional demand still will greatly exceed regional supply.

Most plants produce salt cake as a co-product with hydrochloric acid from salt and sulfuric acid. Since the Southeast has excess hydrochloric acid, the process is not attractive for this area in spite of the availability of inexpensive sulfuric acid.

This situation is expected to change. If a market for hydrochloric acid grows within the CSRA, the co-production of salt cake and hydrochloric acid would be well suited to the area.

Manufacturers believed to be producing these products from salt and sulfuric acid are listed below.

Allied Chemical Corporation
American Agricultural Chemical Company
American Cyanamid Company
Bay Chemical Company
Cornwell Chemical Corporation
Diamond Alkali Company
E. I. du Pont de Nemours & Company
Ethyl Corporation
Hercules Powder Company
Monsanto Chemical Company
National Distillers & Chemical Corporation
Pittsburgh Coke & Chemical Company
Stauffer Chemical Company
Wilson & Company
Wyandotte Chemicals Corporation

Sodium Chlorate

Sodium chlorate is made from salt, primarily for use in pulp bleaching and as a defoliant. Nearly two tons of sodium chlorate can be made from one ton of salt, so there is an advantage in manufacturing near the sizable southeastern market. But since the process requires tremendous quantities of power (5,100-kwh per ton of sodium chlorate), the product is made only where extremely cheap power is available.

A gas turbine can be used to supply cheap power, but only where there is a need for great quantities of heat. Sodium chlorate manufacturing processes use little heat. Consequently, it would be necessary to arrange for the sale of the turbine's heat output in order to manufacture sodium chlorate profitably in the CSRA. The area's brick companies are among the existing potential markets.

Manufacturers of sodium chlorate are listed below.

American Potash & Chemical Corporation
Hooker Chemical Corporation
Olin Mathieson Chemical Corporation
Pennsalt Chemicals Corporation
Pittsburgh Plate Glass Company

Other Products

Expansion of the pulp and paper industry is a distinct possibility in the CSRA. The area has a good supply of pulpwood, and the navigable Savannah River makes it possible to bring in wood from greater distances than would otherwise be feasible. Since it would be somewhat difficult for a new company to establish large and continuing sources of pulpwood supply, however, it is more logical to expect that further development of this industry will take the form of expansion of Continental Can's existing plant. Basic paper products with market potential include newsprint and foodboard.

The possibility of attracting a printed carton manufacturer is enhanced by Procter & Gamble's consumption. But because it would take a large-scale plant to compete with northern manufacturers, Procter & Gamble's purchases for Augusta would not be sufficient reason for the establishment of a printed carton plant in the CSRA. The company presently accepts bids for printed cartons on the basis of its national consumption, and no southeastern manufacturer has bid successfully to date. A manufacturer coming into the area would have to be concerned with the entire southeastern market and, in some cases, the national market.

It is possible that wood resources in the area could be used to make construction board which is non-combustible and has decorative, acoustical, and insulating values, and enough structural strength to be used as a forming material for the pouring of concrete. Building materials with these qualities have an attractive growth potential, but it is difficult to judge which of the many competing types will actually participate in the market's growth. One kind which can be produced within the CSRA uses, as its major raw material inputs, long-strand wood fibers and sodium silicate. Some of the abundant wood in the CSRA may be suitable, and it is likely that competitively priced sodium silicate would be available locally.

Manufacturers of consumer products such as paint, detergents, and beer are likely to show further interest in the area. The fabricated metal products industry is another possibility. In this case, the CSRA's excellent labor supply would be an important attraction. Since the specialty metal chemicals industry uses the variety of chemical raw materials available to Augusta, a manufacturer in this industry could probably be attracted to the area if a small metalworking complex were established in the CSRA.

The area's abundant clay and sand resources should be of interest to ceramics and glass manufacturers. Some northern ceramics manufacturers face imminent depletion of their local clay sources, but it is not clear whether they will import raw materials to their present plants or establish new plants near new sources of raw materials. Glass plant location decisions are based primarily on market considerations, but a manufacturer may locate near low cost fuel and raw material sources within a regional market. Southeastern glass products markets which may attract manufacturers include flat glass, table glassware, and scientific glass.

CONCLUSION

Of the 11 chemical and chemical-related products and product groups considered as manufacturing possibilities for the CSRA, the production of synthetic fibers appears to be best suited to the manufacturing attractions in the area. The CSRA can offer synthetic fiber manufacturers a navigable waterway, proximity to major textile markets in the Piedmont region, and an excellent ground water supply in the Coastal Plain counties. Although a synthetic fiber plant might not be the easiest of the manufacturing potentials to attract, it would offer the best return for effort expended. A single producer of synthetic fibers would create a large number of job opportunities and would provide the basis for the development of satellite supply firms.

Based on market potential and general adaptability to the area, the following products are considered to be the next most promising prospects for manufacture in the CSRA:

Fatty acids and glycerine
Methanol, formaldehyde, and methylamines
Pesticides
Phenol

The fact that each of these products is already produced in the Southeast demonstrates that it is both economically and technologically sound to manufacture in the area. In addition, those companies not represented in the area may need to locate plants to protect their interests in the southeastern market. A determination of which of these products are best suited for manufacture in the CSRA should be based on a more detailed study of raw material availability, together with an analysis of the size and stability of the market which can be economically served.

Three groups of chemical products are especially attractive for manufacture in the CSRA because of the base they would provide for further industrial expansion. They must be considered as uncertain prospects, however, because technical problems or rapidly changing production processes prevent a precise evaluation of their feasibility as manufacturing opportunities in the CSRA. These products are:

Acetylene and acetylene chemicals
Acrylonitrile
Methylene dichloride and perchloroethylene

The three remaining chemical products are limited or long-range prospects for manufacture in the CSRA because of peculiar problems associated with each. Buckeye Cellulose Corporation is the only logical prospective manufacturer of carboxymethyl cellulose in the Augusta area, since it is a subsidiary of Procter & Gamble, the major consumer of the product in the area. Salt cake and hydrochloric acid cannot be produced economically in the CSRA until the area's market for hydrochloric acid expands. The profitable manufacture of sodium chlorate would not be possible in the Augusta area unless an outlet could be found for the heat generated by the gas turbines which would be required to supply a cheap power source.

On the basis of available evidence it is not practical to classify or rank the non-chemical possibilities in terms of feasibility or likelihood of attraction. These possibilities are worthy of further consideration, however, since each is presently manufactured in the Southeast and appears to have additional potential. The development of one or more of these possibilities would contribute significantly to the economic growth of the Central Savannah River Area.